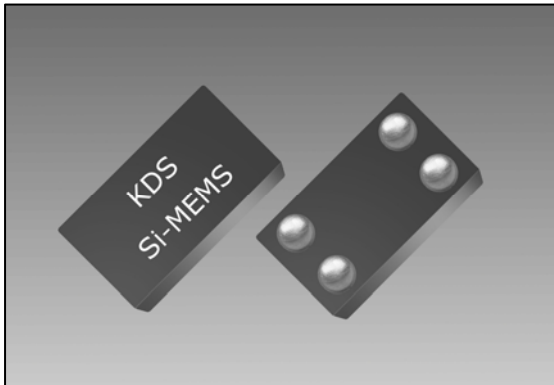


## MO1532



### ■ Features

- Fixed 32.768 kHz
- Smallest footprint in chip-scale (CSP): 1.5 x 0.8 mm
- <math>10^{-6}</math> frequency tolerance
- Ultra-low power: <math><+1 \mu\text{A}</math>
- Internal filtering eliminates external Vdd bypass cap
- NanoDrive™ programmable output swing for lowest power

### ■ Applications

- Mobile Phones, Tablets
- Health and wellness monitors, Fitness Watches
- Pulse-per-second timekeeping, RTC reference clock
- Battery Management Timekeeping



### ■ Standard Specification

Item	symbol	Min.	Typ.	Max.	Unit	Condition
Fixed Output Frequency	F <sub>out</sub>	32.768			kHz	
Operating Supply Voltage	V <sub>dd</sub>	+1.2	-	+3.63	V	T <sub>A</sub> = -10°C to +70°C
		+1.5	-	+3.63		T <sub>A</sub> = -40°C to +85°C
Operating Temperature Range	T <sub>use</sub>	-10~+70 / -40~+85			°C	
Frequency stability [1]	F <sub>stab</sub>	-	-	+75	x10 <sup>-6</sup>	T <sub>A</sub> = -10°C to +70°C, V <sub>dd</sub> : +1.5V – +3.63V
		-	-	+100		T <sub>A</sub> = -40°C to +85°C, V <sub>dd</sub> : +1.5V – +3.63V
		-	-	+250		T <sub>A</sub> = -10°C to +70°C, V <sub>dd</sub> : +1.2V – +1.5V
Frequency Tolerance [2]	F <sub>tol</sub>	-	-	+10	x10 <sup>-6</sup>	T <sub>A</sub> = +25°C, post reflow, V <sub>dd</sub> : +1.5V – +3.63V.
		-	-	+20		T <sub>A</sub> = +25°C, post reflow with board-level underfill, V <sub>dd</sub> : +1.5V – +3.63V
First year Frequency Aging		-1.0	-	+1.0	x10 <sup>-6</sup>	T <sub>A</sub> = +25°C
Core Operating Current [3]	I <sub>dd</sub>	-	+0.9	-	μA	T <sub>A</sub> = +25°C, V <sub>dd</sub> : +1.8V. No load
		-	-	+1.3		T <sub>A</sub> = -10°C to +70°C, V <sub>dd</sub> max: +3.63V. No load
		-	-	+1.4		T <sub>A</sub> = -40°C to +85°C, V <sub>dd</sub> max: +3.63V. No load
Start-up Time at Power-up [4]	T <sub>start</sub>	-	180	300	ms	T <sub>A</sub> = -40°C ≤ T <sub>A</sub> ≤ +50°C, valid output
		-	-	450		T <sub>A</sub> = +50°C < T <sub>A</sub> ≤ +85°C, valid output
LVCMOS Output Option, T <sub>A</sub> = -40°C to +85°C, typical values are at T <sub>A</sub> = +25°C						
Output Clock Duty Cycle	DC	48	-	52	%	
Output Voltage Low	V <sub>OL</sub>	-	-	V <sub>dd</sub> x 0.1	V	V <sub>dd</sub> : +1.5V – +3.63V, I <sub>OL</sub> = +10 μA, 15 pF
Output Voltage High	V <sub>OH</sub>	V <sub>dd</sub> x 0.9	-	-	V	V <sub>dd</sub> : +1.5V – +3.63V, I <sub>OH</sub> = -10 μA, 15 pF
Output Rise/Fall Time	tr,tf	-	100	200	ns	10-90% (V <sub>dd</sub> ), 15 pF load, V <sub>dd</sub> = +1.5V to +3.63V
		-	-	50		10-90% (V <sub>dd</sub> ), 5 pF load, V <sub>dd</sub> ≥ +1.62V
NanoDrive™ Programmable, Reduced Swing Output						
Output Clock Duty Cycle	DC	48	-	52	%	
AC-coupled Programmable Output Swing	V <sub>sw</sub>	-	+0.20 to +0.80	-		MO1532 does not internally AC-couple. This output description is intended for a receiver that is AC-coupled. V <sub>dd</sub> : +1.5V – +3.63V, 10 pF Load, I <sub>OH</sub> / I <sub>OL</sub> = ±0.2 μA
DC-Biased Programmable Output Voltage Low Range	V <sub>OL</sub>	-	+0.35 to +0.80	-	V	V <sub>dd</sub> : +1.5V – +3.63V. I <sub>OL</sub> = +0.2 μA, 10 pF Load.
DC-Biased Programmable Output Voltage High Range	V <sub>OH</sub>	-	+0.60 to +1.225	-	V	V <sub>dd</sub> +1.5V – +3.63V. I <sub>OH</sub> = -0.2 μA, 10 pF Load.
Output Rise/Fall Time	tr,tf	-	-	200	ns	30-70% (V <sub>OL</sub> /V <sub>OH</sub> ), 10 pF Load

[1]. Measured peak-to-peak. Inclusive of Initial Tolerance at +25°C, and variations over operating temperature, rated power supply voltage and load. Stability is specified for two operating voltage ranges. Stability progressively degrades with supply voltage below +1.5V.

[2]. Measured peak-to-peak. Tested with Keysight 53132A frequency counter.

Due to the low operating frequency, the gate time must be ≥100 ms to ensure an accurate frequency measurement.

[3]. Core operating current does not include output driver operating current or load current. To derive total operating current (no load), add core operating current + (+0.065 μA/V) \* (output voltage swing).

[4]. Measured from the time V<sub>dd</sub> reaches +1.5V.

Consult our sales representative for other specifications.

## MO1532

### ■ Dimensions and Patterns

Package Size – Dimensions (Unit: mm)	Recommended Land Pattern (Unit: mm)
<p>1.55 x 0.85 mm CSP</p>	<p>(soldermask openings shown with heavy dashed line)</p> <p>Recommend 4-mil (0.1mm) stencil thickness</p>